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NOTES ON GEOGRAPHIC DISTRIBUTION

An undesirable presence: first record of the exotic ant *Monomorium floricola* (Jerdon, 1851) (Hymenoptera, Formicidae, Myrmicinae) for Peru

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Abstract. *Monomorium floricola* (Jerdon, 1851) is an invasive exotic ant species due to its occurrence outside its native range, its impacts on native species, and economic harm. This study presents the first records of *M. floricola* in Peru, which were collected during field courses in 2012 and 2013 in disturbed areas of the Peruvian Amazon. Given the distance between the recorded locations, its invasive potential, and the previously reported impacts, we emphasize that this is an alarming situation that requires further research on its occurrence and impacts in this region.

Key words. Biological invasion, conservation, distribution, flower ants, impacts

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INTRODUCTION

The ant genus *Monomorium* Mayr, 1855 (Formicidae, Myrmicinae, Solenopsidini) comprises 296 extant species and 22 subspecies, in addition to three fossil species (Bolton 1987, 2024). Ants in this group are generalists in their feeding habits and nesting strategies, and they are distributed across tropical and temperate regions worldwide (Brown 2000). In recent decades, some species of this genus have been introduced to new locations and have become highly successful invasive species (Forel 1911a; Rasheed et al. 2020; Pontieri and Linksvayer 2021), among them, *Monomorium floricola* (Jerdon, 1851).

Monomorium floricola is a tiny ant species characterized by wingless queens (Snelling 2005; Wetterer 2010). Although they are not capable of dispersing through flight like most ant species, they exhibit a series of characteristics that favor their dispersal. Colonies can be polygynous (Wetterer 2010), meaning that they can contain multiple queens (fertile females capable of reproduction) (Hölldobler and Wilson 1990). The formation of new colonies occurs through budding, in which one of the queens leaves her nest, accompanied by other workers, to establish a new colony (Snelling 2005). A single colony can nest in different structures and occupy several nests (polydomy), as well as being able to inhabit very small cavities in plants, which can occasionally be transported, for example, by humans (Wetterer 2010). This combination of characteristics, along with human activities across continents, has led to the species becoming cosmopolitan.

It is possible that *M. floricola* originated in Asia and subsequently spread globally through human activity (Wilson and Taylor 1967). Currently, this species has been reported from the American (Wheeler 1905; Borgmeier 1927; Fernández and Sendoya 2004), African (Santchi 1914; Eidmann 1944; Dorow 1996), European (Sellenschlo 1991; Steiner et al. 2017), and Australian continents (Andersen and Reichel 1994; Andersen et al. 2016), as well as in Asia (Bolton 1987; Jaitrong and Nabhitabhata 2005). In South America, this species is present in several countries (Figure 1), including Bolivia (Verhaagh and Rosciszewski 1994), Brazil (Forel 1908), Chile (Kempf 1970), Colombia (Wetterer 2010), Ecuador (Fernández and Sendoya 2004), Guyana (Menozzi 1935), French Guiana (Radoszkowsky 1884), Suriname (Fernández and Sendoya 2004), Paraguay (Wild 2007), and Venezuela (Wetterer 2010).

Given its current distribution, it would be expected that this species might also occur in neighboring countries, such as Peru (Bezdecková et al. 2015). However, according to the latest update of the local ant fauna list, there is no record of *M. floricola* in this country. To date, the only species of the genus recorded in Peru is *Monomorium pharaonis* (Linnaeus, 1758), also exotic (Bezdecková et al. 2015; Guénard and Economo 2015). In this paper, we report the first record of *M. floricola* from Peru, discuss the potential

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impacts caused by the introduction of this species, and highlight the importance of conducting ant surveys and studies on non-native fauna.

METHODS

The specimens examined were deposited in the Entomological Collection Padre Jesus Santiago Moure (DZUP) at the Universidade Federal do Paraná, Curitiba, Brazil, and were obtained from two independent collections conducted during field courses in the Peruvian Amazon, the Hormigas Neotropicales course (2012), and the Ant Course (2013). These specimens were examined as part of an ongoing study of exotic ant species in Brazil. The identification process was based on the identification guide for ant subfamilies and genera in Brazil (Feitosa and Dias 2024), along the original species descriptions (Jerdon 1851; Mayr 1879), redescriptions (Ettershank 1966; Bolton 1987), and the examination of images of the type material available on the AntWeb.org database, which is hosted and supported by the California Academy of Sciences. The terminology adopted for the species diagnosis presented here follows the aforementioned studies. In the present work, we use the symbol "♀" to refer to the queen caste and the symbol "☿" for workers. Following the analyses, the specimens received unique identifier codes and were digitized and reincorporated into the DZUP collection.

The examination of the specimens was conducted using a Zeiss SteREO Discovery.V8 binocular stereomicroscope. The distribution map presented herein was generated based on the label data (locality information and geographic coordinates) of the specimens. The map was produced using QGIS Desktop v. 3.16.5 with GRASS v. 7.8.5 and Adobe Photoshop CS6. The photos of the specimens were taken with a Zeiss Axiocam 305 camera coupled to a Zeiss SteREO Discovery V20 stereomicroscope. Adjustments to brightness, contrast, and sharpness were made using Adobe Photoshop CS6, and the plates were prepared using Microsoft PowerPoint.

RESULTS

***Monomorium floricola* (Jerdon, 1851)**
Figures 2, 3

New records. PERU – Tambopata • Puerto Maldonado, Tambopata National Reserve, Sachavacayoc Amazon Field Centre; 12°51′12″S, 069°22′01″W; 210 m alt.; 19–31.VIII.2012; R.M. Feitosa leg.; 2 ☿, DZUP 560105 – Cusco • Estación Biológica Villa Carmen; 12°53′41″S, 071°24′13″W; 5–12.VIII.2013; Ant Course; successional vegetation, crops and pasture; 1 ☿, DZUP 560095; 1 ☿ DZUP 560096; 1 ☿ DZUP 560097; 1 ♀, DZUP 560098; 3 ♀ , DZUP 560099; 2 ☿, DZUP 560100; 1 ♀, DZUP 560101; 1 ♀, DZUP 560102; 1 ♀, DZUP 560103; 1 ♀ DZUP 560104; 1 ☿, DZUP 560106; 1 ♀, DZUP 560107; 1 ♀, DZUP 560108.

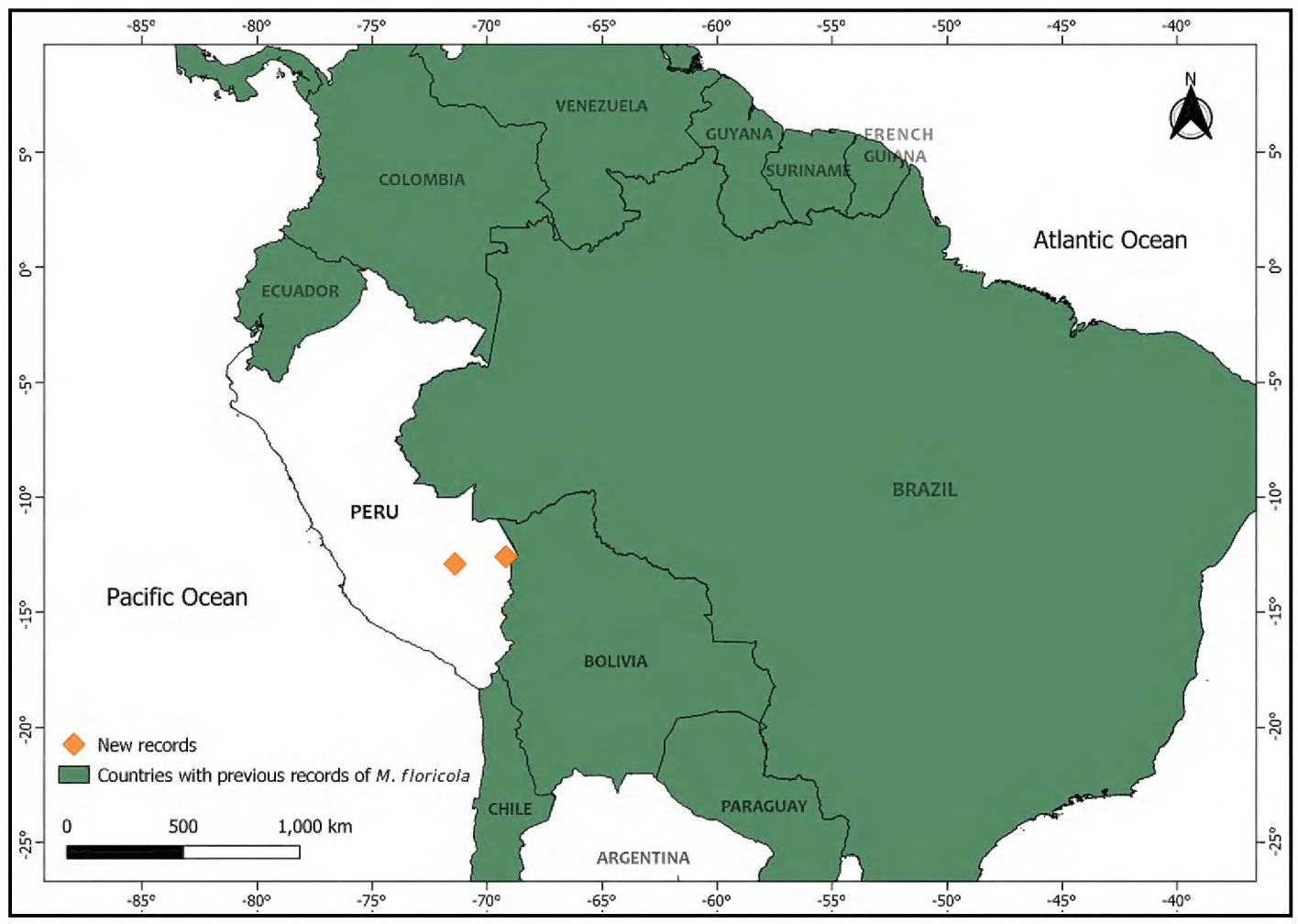

Figure 1. Map of South America, showing the first records of *Monomorium floricola* in Peru and its occurrence in adjacent countries.

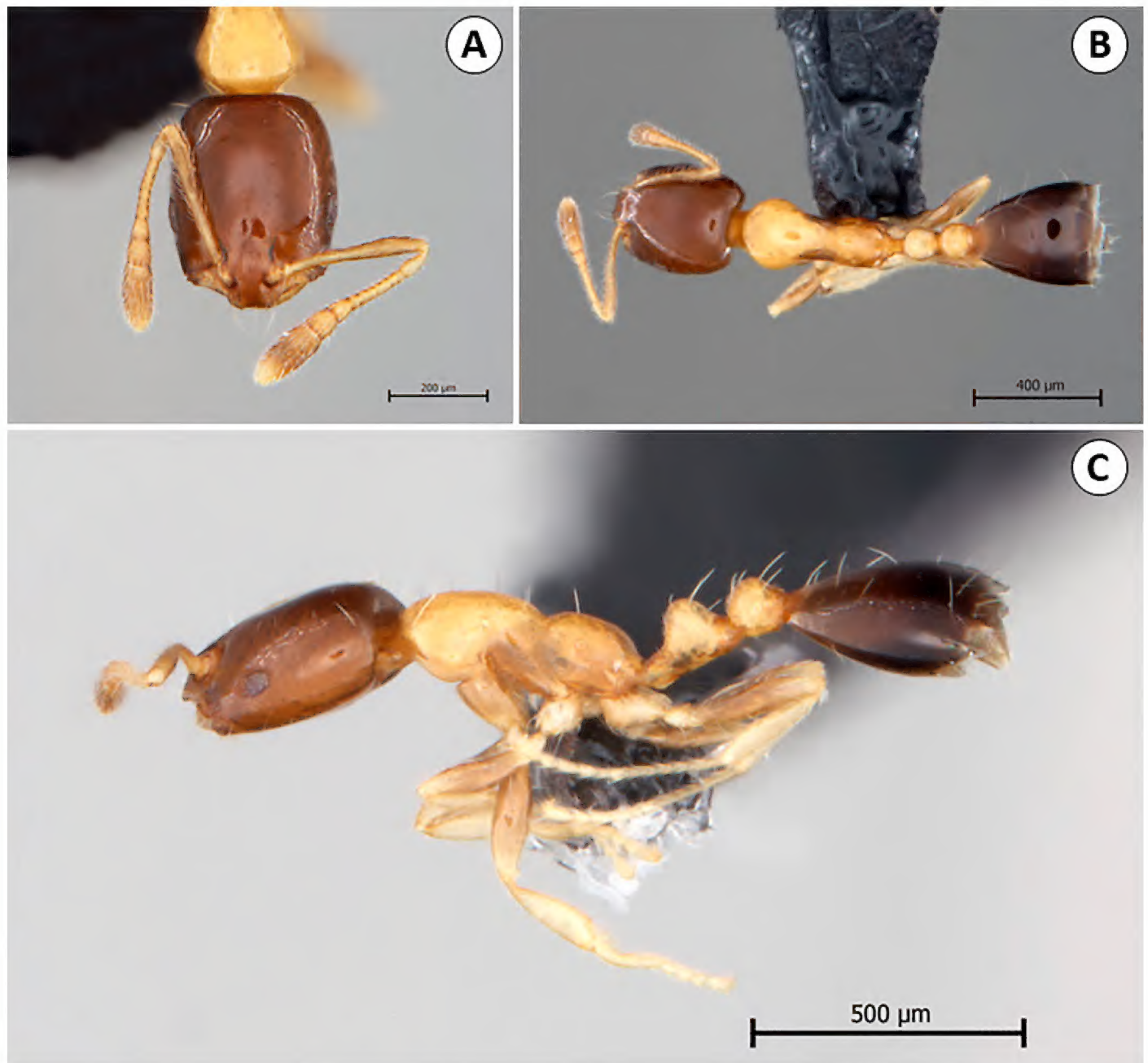

Figure 2. *Monomorium floricola*. Worker (DZUP 560106). **A.** Head in full-face view. **B.** Dorsal view of the body. **C.** Lateral habitus.

Material examined (type material in part, including synonyms). INDONESIA – Maffin Bay [Dutch N. Guinea] • –01.96667, 138.88333; 01.VIII.1944; E.S. Ross leg.; 1 ☿, syntype of *Monomorium angusticlava* Donisthorpe, 1947, CASTYPE06928 [MHNG]. PHILIPPINES – 1 ☿, syntype of *Monomorium floricola philippinensis* Forel, 1910, CASENT0908698. SAMOA –13.803096, –172.17831; Godeffroy leg.; 1 ☿, lectotype of *Monomorium specularis* Mayr, 1866, CASENT0916008. CEYLON [SRI LANKA] • Escherich leg.; 1 ☿, syntype of *Monomorium floricola furina* Forel, 1911b, CASENT0908699 [MHNG] –Peradenyia; Escherich leg.; 1 ♀, syntype of *Monomorium floricola furina* Forel, 1911b, CASENT0917813 [SIZK].

Identification (worker). Head rounded to elliptical; mandibles with 3 or 4 teeth; central clipeal seta present, separated from the lateral setae; frontal lobes poorly developed; antennal scrobes absent; antennae with 12 antennomeres and 3-segmented clubs; dorsum of the mesosoma with a groove, clearly separating the promesonotum and propodeum; propodeum, petiolar node, and metasoma devoid of projections; erect setae sparsely distributed over the entire body; integument smooth, shiny, and with a characteristic bicolored pattern, with the head and gaster dark brown, and mesosoma, petiole, and post-petiole yellowish (Figure 2). *Monomorium floricola* can be distinguished from other species of the genus mainly by coloration and sculpturing pattern. It may be confounded with species of the genus *Pheidole* Westwood, 1839, but the latter can be recognized by the absence of the central clipeal seta and the number of mandibular teeth, which is equal to or greater than four teeth. *Monomorium floricola* is also similar to some species in the genus *Megalomyrmex* Forel, 1885, but species in this genus can be separated by the number of mandibular teeth, with 5 or more teeth; the antennal club, which varies from 3 to 5 segments; and the presence of a transverse carina on the dorsum of propodeum. Finally, *M. floricola* is similar to *Trichomyrmex destructor* (Jerdon, 1851), but this species can be differentiated by the presence of striations on the vertex of the head.

Identification (queen). Similar to the worker, except for the presence of three ocelli, also larger compound eyes; mesosoma larger, without a groove, only with a suture separating the promesonotum from the propodeum; metasoma well developed, as is commonly observed in ant queens; and the overall larger body size. Unlike other species, the queen of *M. floricola* does not have wings (Figure 3).

DISCUSSION

The records presented here belong to a species that is widely recognized as an invasive exotic ant; that is, it has been introduced by human activities to areas beyond its natural distribution, has managed to

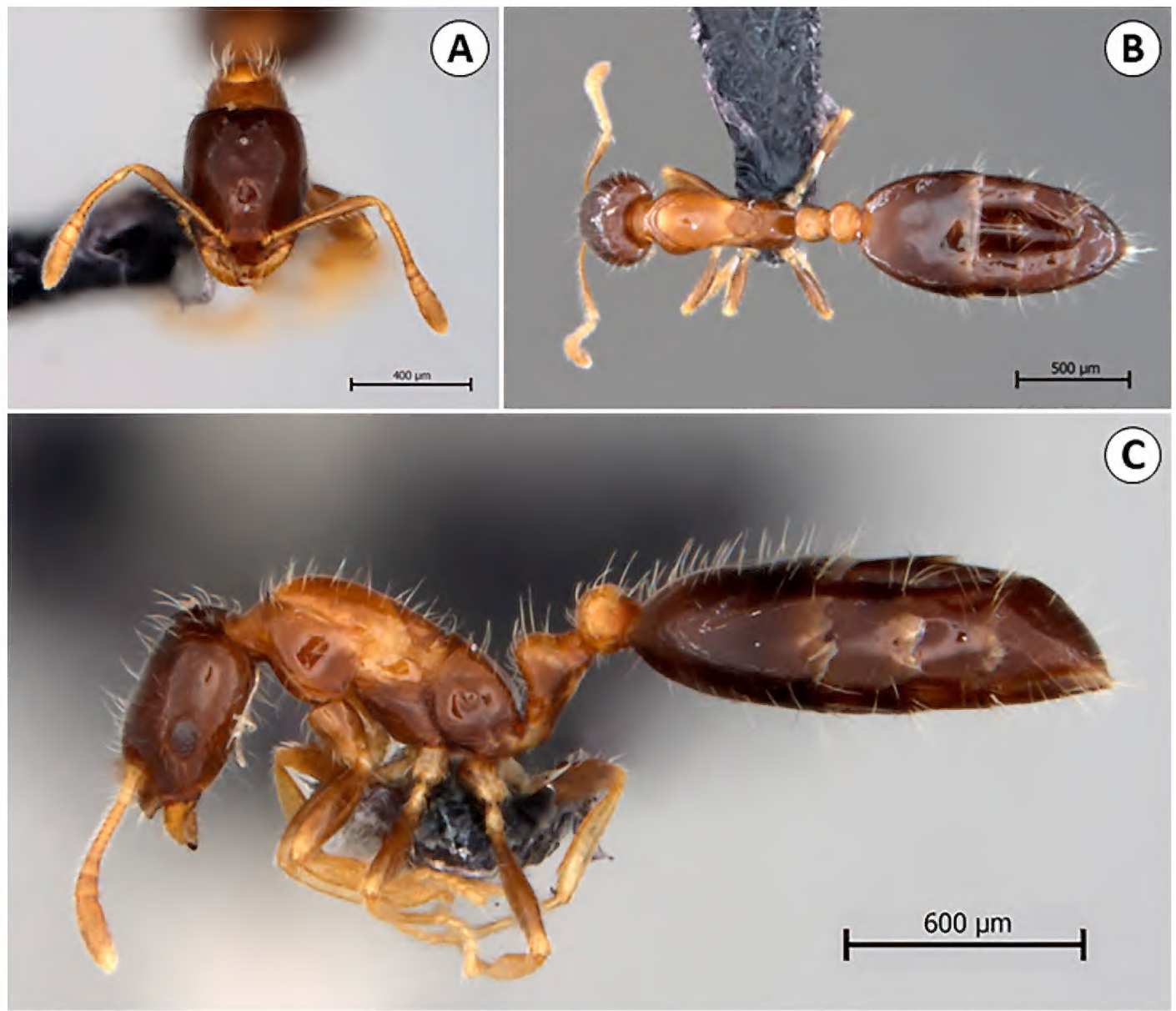

Figure 3. *Monomorium floricola*. Queen (DZUP 560108). **A.** Head in full-face view. **B.** Dorsal view of the body. **C.** Lateral habitus.

establish itself, and subsequently caused negative impacts on native fauna and flora, as well as economic damages (Dekoninck et al. 2019). *Monomorium floricola* is an opportunistic ant species with a high capacity for locating food resources, and it is an excellent exploitative competitor (Aesch and Cherix 2005). This trait, combined with its reproductive strategy, being both polygynous and polydomous (Wetterer 2010), favors its establishment and spread. Currently, *M. floricola* is among the 19 formicid species listed as invasive, and it has one of the broadest distributions, making it a significant focus for the study of biological invasions and native species conservation (Global Invasive Species Database 2024).

The impacts caused by this species range from being a minor pest in domestic and agricultural settings (Deyrup et al. 2000; Wetterer 2010) to causing direct harm to native species, such as the reduction of Nymphalidae butterfly populations in Guam due to egg predation (Nafus 1993) and the predation of the spider *Anelosimus eximius* (Keyserling 1884) in Ecuador due to kleptoparasitic behavior (Padrón et al. 2022). Additionally, *M. floricola* is also a potential pest in hospitals, where it acts as a vector for pathogenic organisms (Moreira et al. 2005).

Specifically regarding the records from Peru, it is noteworthy, albeit negatively, that the species is present in two locations in the Amazon Rainforest, a biome of international importance due to its role in maintaining the planet's climate (Foley et al. 2007) and harboring the greatest biodiversity in the world (Mittermeier et al. 2003). The presence of *M. floricola* in these locations suggests that it is widely distributed throughout the Peruvian Amazon, given that the invasion route may include the extensive river network used for the transportation of goods and people in this region of South America (Ferreira 2006; Wetterer 2010; Bertelsmeier 2021). These data are alarming, especially considering this species' invasive potential and the impacts already documented for other regions, as mentioned earlier.

Additionally, we highlight that the records reported in this study come from two field courses aimed at training researchers in myrmecology, demonstrating not only the importance of these initiatives for the development of qualified human resources but also their potential for documenting occurrences of taxonomic, ecological, and sanitary importance. The records from Villa Carmen, Cusco, in 2013, are in areas of secondary forests, crops, and pastures. These environments are typically exploited by generalist species such as *M. floricola*, which thrive in disturbed areas (Wilson and Taylor 1967). The specimens recorded in Puerto Maldonado, Tambopata, were collected at the Sachavacayoc Amazon Field Centre. It comprises 132 ha of primary and secondary forests (Newton College 2024); however, *M. floricola* ants were found exclusively in disturbed areas near accommodations, where there is increased movement of people and goods. This finding reinforces the species' preference for locations with less direct competition with native ant species (Aesch and Cherix 2005).

Considering the distance between the locations where the species was recorded, its invasive potential, and its presence in countries neighboring Peru, it is crucial to map the occurrence of *M. floricola* throughout

the region and to develop studies focused on the impact of its presence on local biodiversity in areas where the species has been introduced. Only based on these data will it be possible to develop policies aimed at controlling local populations and preventing their introduction into areas not yet affected by their presence.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: VB. Data curation: VB, RF. Formal analysis: VB. Funding acquisition: RF. Investigation: VB. Methodology: VB, RF. Project administration: RF. Validation: VB, RF. Writing – original draft: VB. Writing – review and editing: VB, RF.

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Data availability

All data that support the findings of this study are available in the main text.

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